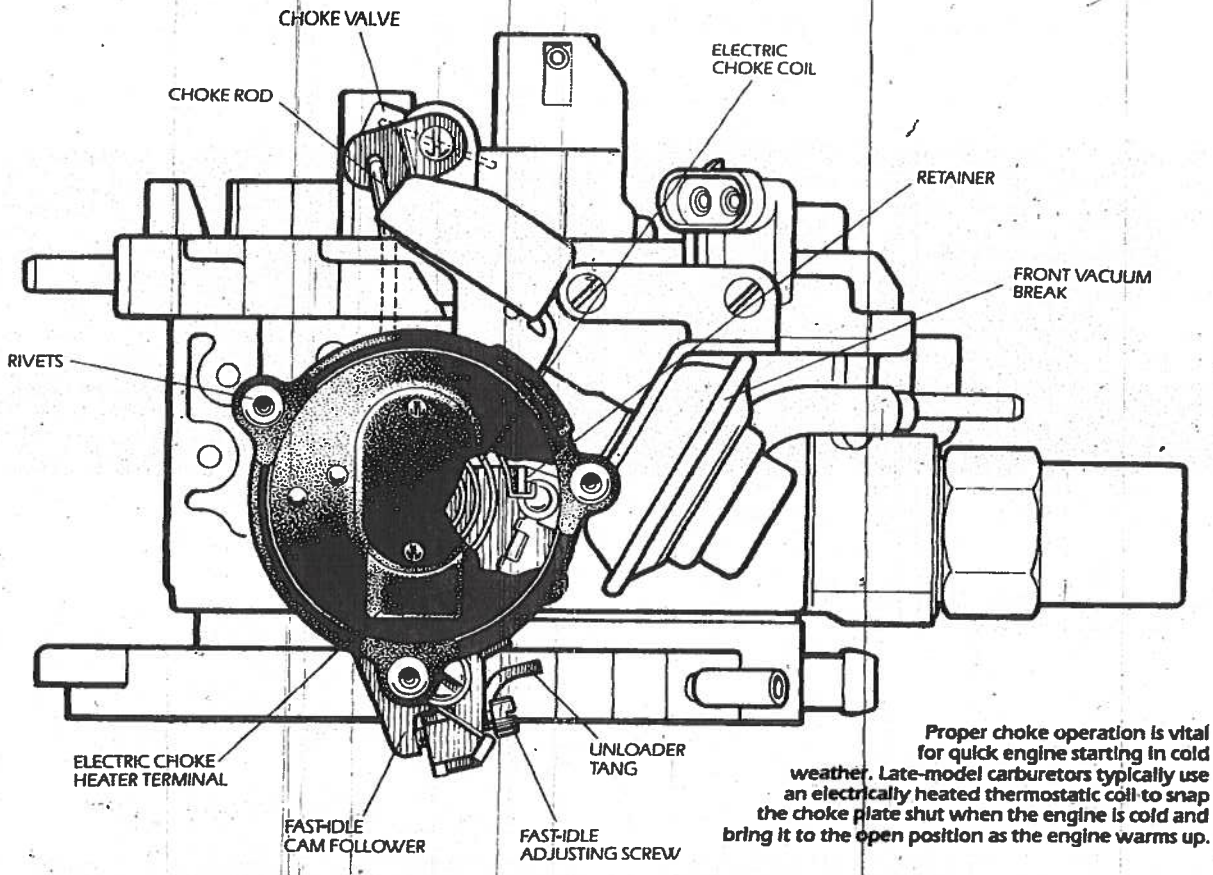


Proper choke operation is vital for quick engine starting in cold weather. Late-model carburetors typically use an electrically heated thermostatic coil to snap the choke plate shut when the engine is cold and bring it to the open position as the engine warms up.

HOW TO SOLVE COLD START PROBLEMS

BY PAUL STENQUIST; Illustrations by Fred Wolfe

Automobiles and extreme cold don't go well together. As the temperature drops, the crankcase oil thickens, making the engine very hard to turn. The battery loses some of its energy. And the fuel puddles, rather than vaporizes.

Today's cars are equipped to overcome these difficulties, but only when everything is as it should be. The lubricant must be of the correct viscosity, the battery must be capable of holding a full charge, the engine must be in a good state of tune and the choke system (or fuel-injection control system) must be functioning properly.

But even if all these variables check out okay, you might have trouble starting your car if you don't use the prescribed starting technique. Mechanics in cold weather cities tell us that the principal cause of cold-weather no-starts is driver error.

Starting technique

If you don't use the proper cold-weather starting method on the first try, it will probably be too late on your second try because the battery quickly loses charge in low temperature and the plugs will be drenched with unvaporized gas. Most carbureted cars must be cold-started in the idle position after slowly pressing the accelerator to the floor one, two or three times. Most fuel-injected cars are cold-started in the idle position without depressing the accelerator. But techniques vary for both types. Read your owner's manual.

If the correct starting technique won't fire the engine, you should look for the cause of the problem (rather than trying to alter your technique to compensate). Both cranking speed and cold-start adjustments are critical.

Cranking speed is affected by both battery charge and oil viscosity. If your oil is too thick, even a fully charged battery won't start your car. Most manufacturers now recommend 5W-30 motor oil for winter use. In some cases, a

10W-40 oil may be too heavy to allow adequate cranking speed. A straight 30- or 40-weight oil is definitely too heavy. Check your owner's manual for a specific cold weather recommendation. Many vehicle manufacturers list recommended engine oil on the basis of the coldest temperature expected.

A fully charged battery is essential when cold weather greatly increases the cranking system's burden. However, even a fully charged battery can't deliver voltage to the starter motor and ignition coil if an accumulation of crud has increased battery cable resistance.

A quick glance at your battery posts should tell you if corrosion is a problem. If the posts and terminals are covered with a powdery white or yellow substance, remove the terminals (negative first) and clean them and the battery with a small brush and a paste made from baking soda and water. If this treatment doesn't get them down to shiny metal, scrape the inside of the cable terminals and the outside of the battery posts with a small knife or a battery terminal cleaning brush. If the terminals are the type that bolt onto the cables, remove them and clean the connection area, or better yet, replace the cables with a set that have terminals molded to the ends of the cables.

Hydrometer 'eye'

Check the charge level of most maintenance-free batteries by examining the hydrometer "eye." Normally, a dark eye means a drained battery, green is okay, clear or yellow indicates a defective battery.

For the battery to start your car, it must be able to produce at least 9.6 volts for 15 seconds while the engine is cranking (at a temperature of 70° F. or above). At zero to 18° below, it should produce about 8.5 volts; at 30° above zero, 9.1 volts.

Your battery will, of course, discharge if you crank your engine for 20 seconds or so in zero-degree weather. But it should be capable of providing enough juice for the 15-second first chance. If it won't, further battery/charging system troubleshooting and repair is called for.

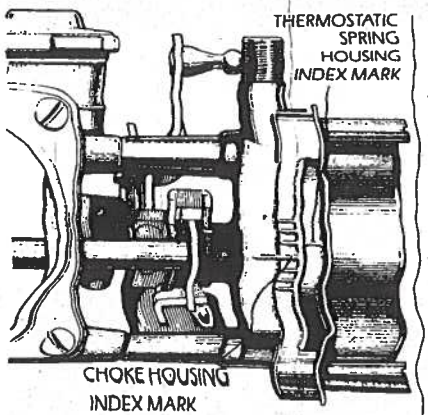
If, on the other hand, the battery seems to take a charge and checks out okay with a hydrometer but the engine still cranks slowly, you may have starter motor or internal engine problems. Further diagnosis—checking starter amperage draw, or torque required to turn the engine—will be necessary.

If you discharged the battery by cranking the engine for a considerable time, you should remove it (negative cable first), take it to a warm place and hook it up to a battery charger. Be careful when handling a battery. If you allow it to come in contact with your clothing, the acid will burn big holes in the fabric. Use old rags or a battery carrying strap to keep it well away from you. Discard any rags that have come into contact with the battery.

A 6- or 10-amp trickle charger will do a good job of charging batteries that have not been drained completely. A battery that still holds some charge may reach full charge in a few hours, but one that is almost fully discharged may require as much as 24 hours.

To determine when full charge has been reached, check a conventional battery with a hydrometer. To determine when a maintenance-free battery is fully charged, check its hydrometer eye as described above. Some fully discharged maintenance-free batteries have to be charged for a long time with a high-amperage service station-type charger. Don't attempt to charge a maintenance-free battery that has a clear or yellow hydrometer eye.

Jump-starting can also help to get you going in a pinch. But it's less effective than a recharge, as your battery will be left in a partly discharged condition if you don't drive the car for a few hours before shutting it off.



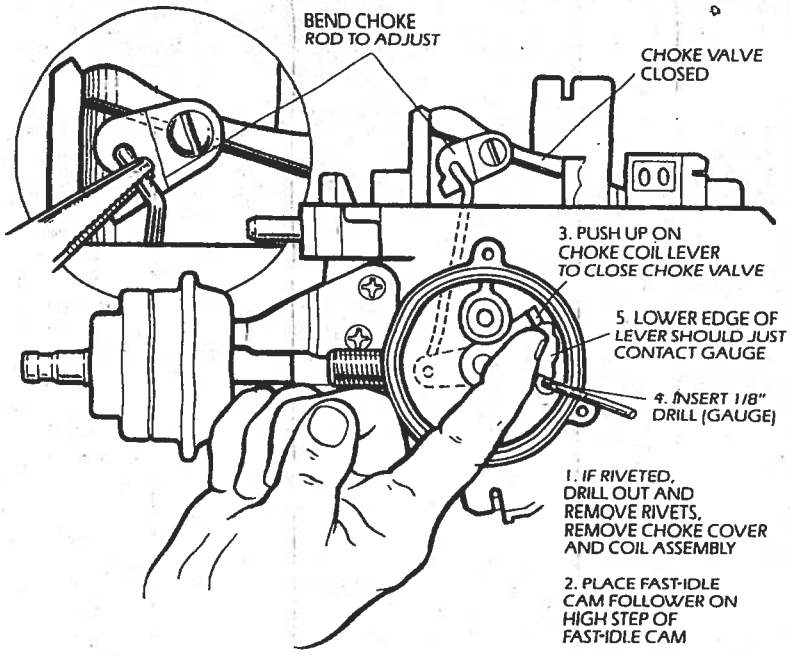
Choke closing tension can be adjusted by aligning the index marks to factory spec.

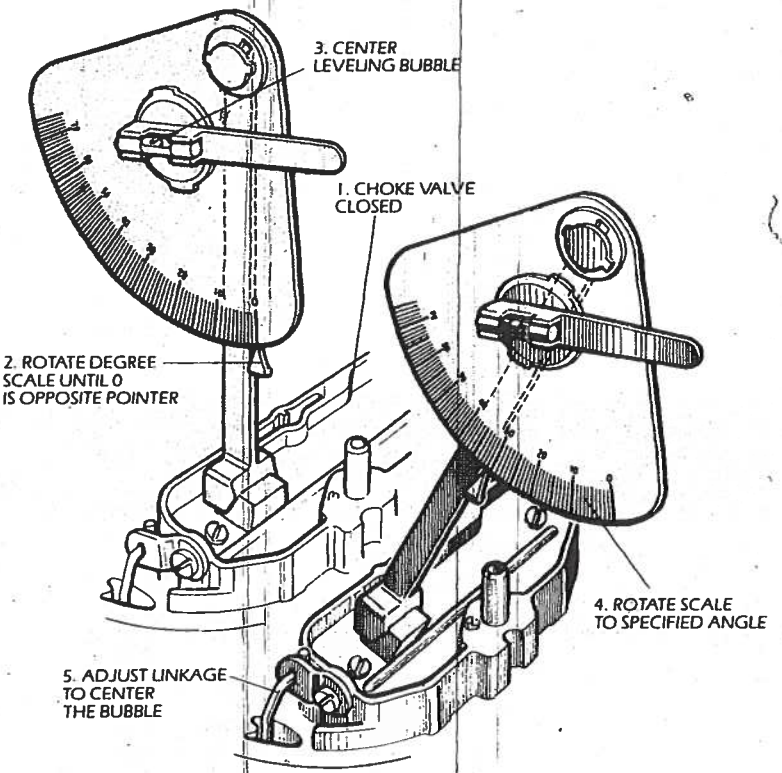
Finding the cause

While your battery is recharging, you'll have to try to figure out why the car didn't start on your first attempt. If your engine cranked at an adequately fast pace and wouldn't fire in 15 seconds or so, you probably have a cold-start (choke) system malfunction, a tuneup-related problem (like sparkplugs, distributor cap, cables, filters) or a fuel line freeze-up.

Eliminate the possibility of fuel line freeze-up right away on carbureted cars. Remove your air cleaner or its top cover and climb up somewhere where you can see into the carb. Shine a flashlight directly into the carburetor barrels. Then hold the choke open (if it's already open you have a choke problem) and open the throttle.

You should see fuel squirt out of the accelerator pump nozzles when you open the throttle. If you don't, the fuel line is probably frozen. To thaw, let it sit


BEND CHOKE ROD TO ADJUST
CHOKE VALVE CLOSED
3. PUSH UP ON CHOKE COIL LEVER TO CLOSE CHOKE VALVE
5. LOWER EDGE OF LEVER SHOULD JUST CONTACT GAUGE
4. INSERT 1/8" DRILL (GAUGE)
1. IF RIVETED, DRILL OUT AND REMOVE RIVETS, REMOVE CHOKE COVER AND COIL ASSEMBLY
2. PLACE FAST-IDLE CAM FOLLOWER ON HIGH STEP OF FAST-IDLE CAM
On carbs with fixed spring housings, the position of the choke valve lever must be gauged with an 1/8-in. drill. The setting is corrected by slightly bending linkage rod.


3. CENTER LEVELING BUBBLE
1. CHOKE VALVE CLOSED
2. ROTATE DEGREE SCALE UNTIL 0 IS OPPOSITE POINTER
4. ROTATE SCALE TO SPECIFIED ANGLE
5. ADJUST LINKAGE TO CENTER THE BUBBLE

To adjust the vacuum break and fast-idle/choke relation angles on late-model GM carbs, use a choke-valve angle gauge as shown above. Auto parts stores carry the gauge.

for half a day or so in a warm place.

You can probably avoid fuel line freeze-up by using a fuel deicer. However, if your tank contains a lot of water (the cause of fuel line freeze), you may have to have it drained.

Choke adjustment

While you're checking to see if fuel is available, pay attention to the operation of the choke plate or valve. Once you've determined that the accelerator pump nozzles squirt fuel, release the choke plate while holding the throttle open. The choke should snap to a closed or nearly closed position.

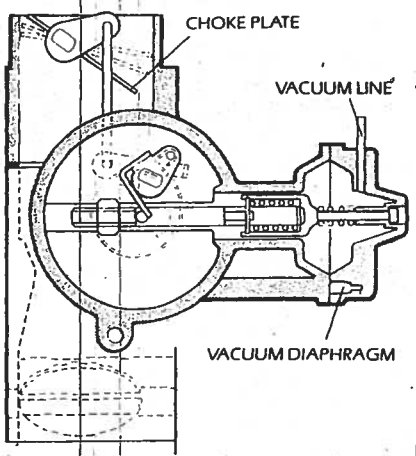
If it doesn't move smartly into position, the choke linkage may be jammed with crud and corrosion. Try cleaning the external linkage parts with carb cleaner and a small solvent brush.

If the choke valve won't snap closed after cleaning the linkage, the malfunction must be corrected. It could be a simple misadjustment, but it's also possible that the thermostatic coil, which closes and opens the choke valve on most cars, is worn out.

On most cars the thermostatic coil is inside a housing attached to the side of the carburetor (see lead illustration). On early model cars, the housing is secured by three screws, but on late models it's held by rivets in order to prevent tampering. To tamper (which you are allowed to do if you have to fix your choke), simply drill out the rivets. When reinstalling the housing, use self-tapping screws to retain it. These, with their special washers, can be purchased at an auto parts store.

The thermostatic coil within the housing holds the choke plate closed when the engine is cold. As the engine warms, the coil is heated and tension is released. Heat is usually provided by exhaust, an electric heater or both.

On some GM and Chrysler products the thermostatic coil is located in a heat stove that mounts on the manifold and is connected to the choke plate with a linkage rod.



Holley-type carbs use a vacuum break to open the choke slightly after car's startup.

On cars with a carb-mounted thermostatic coil, choke adjustment usually is accomplished by turning the housing until a specified mark aligns with a pointer on the carb. However, on most late-model GM cars, the cover is installed in a specific position. Adjustment is accomplished by gauging the position of the choke valve lever with a drill bit or plug gauge. The adjustment is corrected by bending a linkage rod until the lever is in the correct position.

On most cars with intake manifold-mounted thermostatic coils, adjustment is made by bending the rod that joins the well to the choke plate lever.

In either case, a service manual is required. You'll find directions and specifications for most models in professional editions of general repair manuals. These books are available in most libraries. Of course, the complete factory service manual for your vehicle is the best source of information. It's available through your dealer's parts department. No serious Saturday Mechanic should be without the factory service manual for his or her car.

While a correct choke adjustment alone may be enough to get it started, the vehicle won't operate properly when cold if you don't make the other choke system adjustments. On most cars, these include choke vacuum break adjustment, fast-idle setting and a fast-idle/choke relation adjustment.

To complete some of these adjustments on 1978 and later GM cars, you'll need a choke valve angle gauge. This is available at auto parts stores.

For most procedures, the gauge is mounted on the choke plate by means of its magnetic base. The choke plate is then closed, and the tool's scale is rotated until 0 is opposite the gauge's pointer. The bubble level on the gauge is then adjusted until the bubble is centered. The scale is rotated to the angle specified for the particular procedure, after linkage rods or other components have been positioned according to the instructions. Check the position of the bubble. If it's off-center, an adjustment must be made. For most carbs, this is accomplished by bending a linkage rod.

Many cars equipped with Holley-type carburetors use a vacuum break device to open the choke slightly after startup. If this is incorrectly set, there will be an over-rich condition while the car warms up, and driveability will suffer. On Ford products, the adjust-

ment is checked by gauging the amount the choke opens when vacuum is applied to the diaphragm, and it can be reset to the shop manual specification with an adjustment screw on the diaphragm. Cars using remote-mounted vacuum breaks generally require slight bending of an adjustment rod to bring the choke plate angle back to spec.

Resetting the fast-idle speed is also required when any choke adjustment has been changed. On most carburetors, the fast-idle screw rests on a stepped fast-idle cam. Position the screw on the proper step as called for in the shop manual. Turn the screw left or right as required to match the rpm level called for by the maker.

Other problems

If you found that choke and choke-system adjustments were okay, the cause of the cold no-start has not been determined. Although internal damage or other serious problems could be the cause, it may be the engine is simply in need of normal maintenance.

Check the sparkplugs. If the electrodes have eroded or have been fouled, the voltage available under cold-cranking conditions may not be enough to fire them. Clean and gap them if slightly worn or replace them.

If the plugs are wet with fuel, you probably flooded the engine trying to start it. This may be the case if your choke was misadjusted or stuck open. Dry the plugs completely. You'll have to get them into a warm place or spray them with plug cleaning solvent. Then, gap and reinstall them.

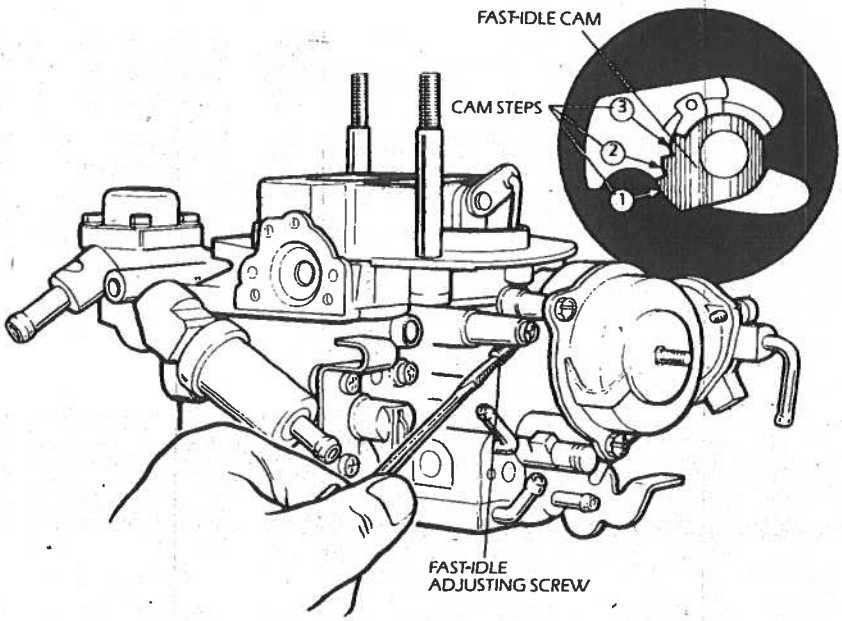
Other problems that might contribute to a no-start include a bad distributor cap, leaking ignition cables or coil tower, a defective coil and other types of ignition failure.

Check the January '85 *Saturday Mechanic* (page 65) on electronic ignition maintenance and diagnosis for more on ignition problems.

Fuel-injected cars

Most late-model, fuel-injected cars have a cold-start system that is integrated with the engine's electronic control system. If cold no-start is a problem, the self-diagnostic trouble codes have to be checked in the vehicle service manual.

Some manufacturers provide additional checklists that should be consulted when a problem is evident but no trouble code has been set. For example, on cars with TBI, GM specifies 15 different items that should be checked when hard starting is experienced and no trouble codes are set. These include checking the fuel pump relay, throttle-position sensor, coolant-temperature sensor and fuel pump check valve.



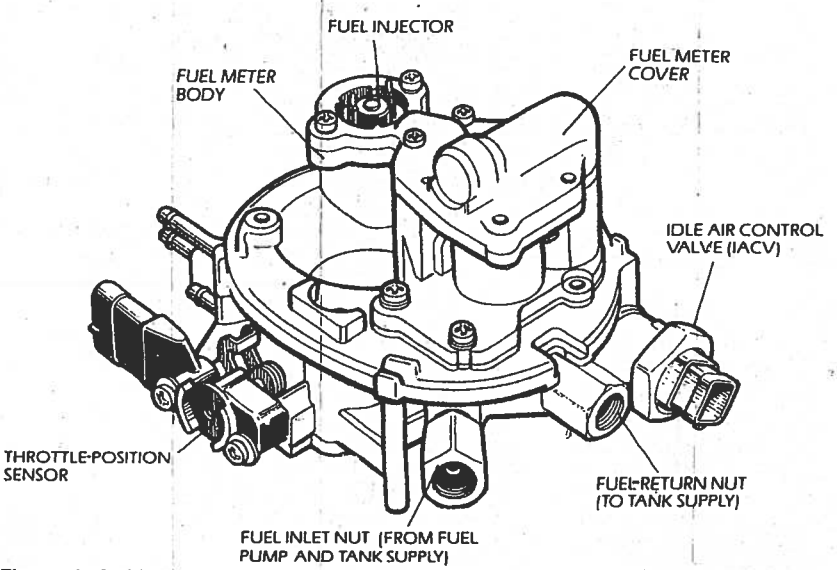
The fast-idle speed must be rechecked after any choke adjustment. Set the fast-idle screw on the proper step of the fast-idle cam, as is called for in the service manual.

Imported cars equipped with Bosch L-Jetronic and K-Jetronic fuel injection systems have cold-start valves that provide extra fuel for initial startup. If this valve doesn't function properly, you won't be able to start the engine when the temperature drops.

In general, K-Jetronic cold-start valves are tested by removing the valve, holding it over a container and attaching a current supply to the valve to see if it sprays. (Obviously, this can be dangerous. Don't attempt this test without a factory service manual.)

L-Jetronic cold-start valves are usually tested by hooking a special fuel system pressure gauge into the fuel-supply line. The valve is then activated, and the technician watches to see if pressure drops at the prescribed rate.

Of course, the cold-start valve isn't the only Bosch injection component that can cause a cold no-start problem. Fourteen items are listed as possible causes. A service manual is needed for most Bosch injection problems. **PM**


FUEL INJECTOR
FUEL METER BODY
FUEL METER COVER
IDLE AIR CONTROL VALVE (IACV)
THROTTLE-POSITION SENSOR
FUEL-RETURN NUT (TO TANK SUPPLY)
FUEL INLET NUT (FROM FUEL PUMP AND TANK SUPPLY)

Electronic fuel-injection systems have no conventional choke, but they do use built-in electronic controls to provide a richer mixture for cold-weather starting.